

PATENT ABSTRACTS OF JAPAN

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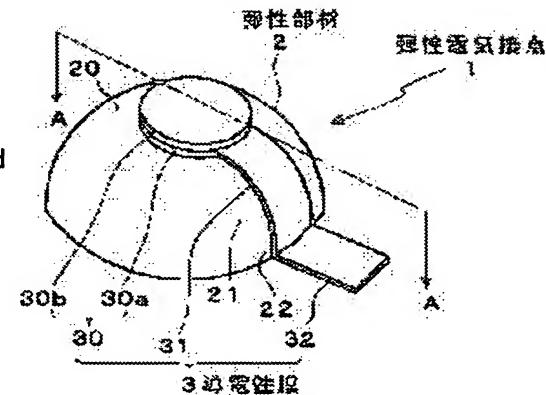
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(54) ELASTIC ELECTRIC CONTACT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an elastic electric contact in which a service life can be prolonged and an electric connection is surely enabled.

SOLUTION: An elastic electric contact 1 is composed of an elastic member 2 and a conductive film 3. Concretely, the elastic member 2 is formed by forming silicon into a semi-spherical shape, and the band-like conductive film 3 is stuck from the top end face 20 of the elastic member 2 along with its side face 21. The conductive film 3 is composed of a head 30, a body 31 and an extended part 32 integrally formed from titanium and palladium. Then, the head 30 is formed from a lower layer 30a and a gold plating upper layer 30b.



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CLAIMS

[Claim(s)]

[Claim 1] Elastic electric contact characterized by what it has an edge in the apical surface of the elastic member of an abbreviation semi-sphere configuration, and this elastic member, and results [from this apical surface] in the base side of an elastic member along the front face of an elastic member, and the band-like conductive film which extended to the method of outside [base] is provided for.

[Claim 2] Elastic electric contact characterized by what the thickness of the edge of the above-mentioned conductive film was set up for by 10 times [1 time to] the thickness of other parts in elastic electric contact according to claim 1.

[Claim 3] Elastic electric contact characterized by what meat omission of the base of the above-mentioned elastic member was performed, and the centrum was formed in the base concerned for in elastic electric contact according to claim 1 or 2.

[Claim 4] Elastic electric contact characterized by what the above-mentioned elastic member was formed for by silicone rubber in elastic electric contact according to claim 1 to 3.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the structure of elastic electric contact which can be used for a semi-conductor substrate, the circuit board, INTAPOZA, an IC socket, a bare chip checking socket, etc.

[0002]

[Description of the Prior Art] Conventionally, there is a technique given in JP,61-259548,A as this kind of elastic electric contact. Drawing 16 is the fragmentary sectional view showing this Prior art. In drawing 16, signs 201,202,203 are a semi-conductor substrate, aluminum wiring, and an insulating layer, respectively, and elastic electric contact 210 is electrically connected to the aluminum wiring 202 of the semi-conductor substrate 201. Elastic electric contact 210 consists of a barrier layer 211 which vapor-deposited and formed aluminum and

nickel in the aluminum wiring 202 with vacuum evaporation technique, an elastic member 212 which piled silicone rubber in the abbreviation semi-sphere type by screen-stencil, and formed it on the barrier layer 211, and a conductive layer 213 as conductive film which gold-plated uniform thickness and was formed in all the front faces of an elastic member 212.

[0003] He is trying to plan positive electrical connection of elastic electric contact 210 and a land 221 with the elasticity of an elastic member 212 by making the semi-conductor substrate 201 and a glass substrate 220 approach, and pressing either the semi-conductor substrate 201 or the glass substrate 220 to the other side by this configuration, where elastic electric contact 210 and a land 221 are contacted.

[0004]

[Problem(s) to be Solved by the Invention] However, there are the following problems in above-mentioned conventional elastic electric contact 210. First, since the conductive layer 213 has covered all the front faces of an elastic member 212, a crack occurs in a conductive layer 213 and it is easy to wake up a faulty connection. That is, when elastic electric contact 210 is pressed on a land 221, positive electrical installation of elastic electric contact 210 and a land 221 is planned because a conductive layer 213 follows and deforms into an elastic member 212. However, the elastic modulus of a conductive layer 213 — modulus ratio **** of an elastic member 212 — it is remarkably small, and since it moreover has structure in which the conductive layer 213 covered all the front faces of an elastic member 212, at the time of press of elastic electric contact 210, a conductive layer 213 may follow, and may not deform into an elastic member 212, but a crack etc. may be generated. A conductive layer 213 is worn out and elastic electric contact 210 stops next, becoming useful for a short period of time. That is, although the semi-conductor substrate 201 is lowered to a perpendicular direction V and elastic electric contact 210 is contacted to a land 221, the semi-conductor substrate 201 moves to a horizontal direction H slightly after contact to elastic electric contact 210 and a land 221 actually. For this reason, contact partial 213a which is a part for the point of elastic electric contact 210 will be worn out by friction with a land 221. Since a conductive layer 213 is thin gold plate of uniform thickness at this time, contact partial 213a of a conductive layer 213 will be worn out by the fricative repeat for a short period of time. Consequently, there is a possibility that an elastic member 212 may become unreserved and elastic electric contact 210 may become unusable by contact partial 213a for a short period of time.

[0005] It was made in order that this invention might solve the technical problem mentioned above, and it aims at offering elastic electric contact in which protraction of a life and positive electrical installation are possible.

[0006]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, elastic electric contact concerning invention of claim 1 has an edge in the apical surface of the elastic member of an abbreviation semi-sphere configuration, and this elastic member, and resulted [from this apical surface] in the base side of an elastic member along the front face of an elastic member, and was considered as the band-like conductive film which extended to the method of outside [base], and the configuration to provide. By this configuration, where the conductive film of elastic electric contact is connected to electrodes, such as a semi-conductor substrate, if the base side of an elastic member contacts the point of installation and elastic electric contact to a semi-conductor substrate at the land of the circuit board etc., the edge of the conductive film will contact a land, and electrical installation of the circuit board and a semi-conductor substrate is planned. Since the conductive film is formed in band-like and has not covered the whole elastic member surface although the elastic member of elastic electric contact deforms if a semi-conductor substrate is pressed to a circuit board side, the conductive film follows and deforms into an elastic member.

[0007] Furthermore, invention of claim 2 is considered as the configuration which set up the thickness of the edge of the conductive film by 10 times [1 time to] the thickness of other parts in elastic electric contact according to claim 1. The prolonged activity corresponding to the thickness of an edge by the time it wears out the edge of the conductive film of elastic electric contact thoroughly by friction with the land of the circuit board etc. and an elastic member is exposed with this configuration is possible.

[0008] It has considered as the configuration which invention of claim 3 performed meat omission of the base of an elastic member in elastic electric contact according to claim 1 or 2, and formed the centrum in the base concerned especially. From that of this configuration, flexibility arises in the base side of an elastic member.

[0009] By the way, although the construction material of an elastic member and the conductive film is arbitrary, invention of claim 4 is considered as the configuration which formed the elastic member by silicone rubber in elastic electric contact according to claim 1 to 3 as the good example.

[0010]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is explained with reference to a drawing.

(1st operation gestalt) Drawing 1 is the perspective view showing elastic electric contact concerning the 1st operation gestalt of this invention, and drawing 2 is the view A-A sectional view of drawing 1. As shown in drawing, elastic electric contact 1 is equipped with an elastic member 2 and the conductive film 3, and becomes.

[0011] An elastic member 2 is what formed silicon in the semi-sphere configuration as the mold, and it adheres to the band-like conductive film 3 along the side face 21 from the apical surface 20.

[0012] The conductive film 3 consists of a head 30 (edge), a drum section 31, and the extension section 32, and lower layer 30a, the drum section 31, and the extension section 32 of a head 30 are formed in one of titanium and palladium.

[0013] It adheres the circle configuration to lower layer 30a of a head 30 on the apical surface 20 of nothing and an elastic member 2. And the laminating of the up layer 30b of isomorphism is carried out on this lower layer 30a. Besides, member 30b is formed of gold plate, and constitutes the head 30 with lower layer 30a.

[0014] The drum section 31 of the conductive film 3 is in the condition pulled out from nothing and lower layer 30a in band-like, and has reached the base 22 along the side face 21 of an elastic member 2. The extension section 32 is in the condition pulled out from the above-mentioned drum section 31, and only predetermined die length has extended to the way outside the elastic member 2. And only the thickness of upper part [thickness / of the drum section 31 of others / thickness / of a head 30 / or the extension section 32] layer 30b is thick. With this operation gestalt, thickness T of a head 30 was set up the twice of thickness t of a drum section 31 (extension section 32).

[0015] Next, the manufacture approach of elastic electric contact 1 of this operation gestalt is explained. Elastic electric contact 1 is manufactured through an elastic member formation process, a following conductive film formation process, and a following thickening process. Drawing 3, drawing 4, and drawing 5 are order process drawings showing an elastic member formation process, a conductive film formation process, and a thickening process, respectively.

[0016] First, in an elastic member formation process, as shown in (a) of drawing 3, the mold 100 which has hole 100a of a semi-sphere configuration is prepared, and as shown in (b) of this drawing, a release agent 101 is applied to the front face of a mold 100. And after a release agent 101 dries, it is filled up with silicon 2' in hole 100a of a mold 100, and as shown in (c) of this drawing, as shown in (d) of this drawing, the insulating film 102 is stuck so that silicon 2' may be covered. After silicon 2''s solidifying and forming the elastic member 2 of a semi-sphere configuration after an appropriate time, an elastic member formation process is ended by exfoliating the insulating film 102 which the elastic member 2 fixed from a mold 100.

[0017] Next, in a conductive film formation process, as shown in (a) of drawing 4, a shadow mask 103 is arranged on the elastic member 2 which fixed on the insulating film 102. (b) of drawing 4 R> 4 is the top view seen from the upper part of this drawing (a). As shown in this drawing, the hole 104 of the shape of a matchstick with round shape hole 104a and band-like hole 104b in a shadow mask 103 is drilled. Therefore, through a hole 104, by vapor-depositing titanium and palladium, as shown in (c) of drawing 4, the conductive film 3 is formed on an elastic member 2. As shown in (d) of drawing 4, lower layer 30a of the conductive film 3 is formed by the apical surface of an elastic member 2, and, specifically, a drum section 31 is formed by the side face of an elastic member 2. And the extension section 32 is formed on the insulating film 102, and a conductive film formation process is completed.

[0018] Finally, as a thickening process is shown in (a) of drawing 5, and an elastic member 2 and the conductive film 3 are covered, a photoresist 105 is applied on the insulating film 102. And lower layer 30a of the conductive film 3 and a corresponding part are etched, and hole 105a is formed in (b) of this drawing so that it may be shown. (c) of drawing 5 is the top view seen from the upper part of (b) of this drawing. As shown in this drawing, hole 105a is set up lower layer 30a and in the shape of isomorphism. As shown in the top view (e) seen from (d) of this drawing, and the upper part of this drawing after an appropriate time, manual gold plate is performed through hole 105a of a photoresist 105, and a thickening process is ended by making up layer 30b adhere on lower layer 30a.

[0019] As mentioned above, after carrying out sequential execution of an elastic member formation process, a conductive film formation process, and the thickening process, as shown in (a) of drawing 6, and (b) by removing a photoresist 105 at the last, elastic electric contact 1 which appeared on the insulating film 102 can be obtained.

[0020] Next, the example of an activity of the above-mentioned connector 1 is explained. Drawing 7 is the

sectional view showing the example which used elastic electric contact 1 for INTAPOZA. This INTAPOZA 110 has structure which installation and these elastic electric contact 1-1 were minded for elastic electric contact 1 (1-1, 1-2) of a couple, it minded [of the insulating film 102] through hole 102a of the insulating film 102 for 1-2, and was electrically open for free passage. That is, two or more through hole 102a in which the medial surface adhered to copper foil 102b is prepared in the predetermined part of the insulating film 102. And elastic electric contact 1-1 of a couple and 1-2 will be arranged in both sides by each through hole 102a soon, and the extension section 32 of each elastic electric contact 1 is electrically connected with copper foil 102b at it.

[0021] Drawing 8 is the sectional view showing the example which used INTAPOZA 110, in order to connect IC chip and the burn-in socket as a semi-conductor substrate. In drawing 8, a sign 111 is IC chip and a sign 112 is a burn-in socket. If INTAPOZA 110 is contained in the burn-in socket 112 as shown in drawing, elastic electric contact 1-2 of the INTAPOZA 110 bottom will contact land 112a of the burn-in socket 112. And if the IC chip 111 is laid on INTAPOZA 110, elastic electric contact 1-1 of an INTAPOZA 110 upside will contact electrode 111a of the IC chip 111. If the IC chip 111 and the burn-in socket 112 are illustrated, twisted and stopped in this condition and it pinches by means of a spring etc., the IC chip 111 will descend and INTAPOZA 110 will be pressed. Since elastic electric contact 1-1 and 1-2 are compressed into an INTAPOZA 110 side by this to be shown in drawing 9, according to the elastic force of the elastic member 2 of each elastic electric contact 1-1 (1-2), up layer 30b of the conductive film 3 of elastic electric contact 1-1 carries out a pressure welding to electrode 111a of the IC chip 111, and up layer 30b of elastic electric contact 1-2 carries out a pressure welding to land 112a of the burn-in socket 112. Consequently, electrode 111a and land 112a are open for free passage through copper foil 102b of elastic electric contact 1-1, the conductive film 3 of 1-2, and the insulating film 102, and the IC chip 111 and the burn-in socket 112 will connect electrically through INTAPOZA 110.

[0022] By the way, if the IC chip 111 descends, while the head 30 of the conductive film 3 of elastic electric contact 1-1 will be caudad pressed by electrode 111a, the head 30 of the conductive film 3 of elastic electric contact 1-2 is pressed up by land 112a. Since the conductive film 3 of elastic electric contact 1 has not covered the whole surface of an elastic member 2 at this time, it will follow and bend in deformation of an elastic member 2. That is, for example, supposing the conductive film 3 has covered the whole surface of an elastic member 2, the cross section of the conductive film 3 will become a configuration like an arch-like ends supporting beam, as shown in drawing 10. For this reason, when the big lower part force F works, there is a possibility that the conductive film 3 may avoid and a crack may arise according to the hauling force by component-of-a-force Ftheta and Ftheta' of a tangential direction. On the other hand, since that cross section is carrying out a configuration like a half-arch-like cantilever as shown in drawing 11, if the big lower part force F works, the hauling force by component-of-a-force Ftheta of that tangential direction will not be committed, but the conductive film 3 will only be caudad bent by the conductive film 3 of this operation gestalt. Thus, according to elastic electric contact 1 of this operation gestalt, since a crack does not arise on the conductive film 3 at the time of the press to elastic electric contact 1, the positive electrical installation by elastic electric contact 1 is possible.

[0023] Moreover, if the desorption to the burn-in socket 112 of the IC chip 111 is repeated, by the time it will wear most heads 30 out since thickness T of a head 30 is set up the twice of thickness t of a drum section 31 (extension section 32) as mentioned above although the head 30 of the conductive film 3 is worn out by friction of electrode 111a or land 112a and the point of an elastic member 2 will be exposed, the repeat of attachment and detachment of the count of considerable is required. Therefore, the life of this elastic electric contact 1 can be said to be very long compared with the life of above-mentioned conventional elastic electric contact 210.

[0024] (2nd operation gestalt) Drawing 12 is the perspective view showing elastic electric contact concerning the 2nd operation gestalt of this invention, and drawing 13 is the view B-B sectional view of drawing 12. As elastic electric contact 1' of this operation gestalt is shown in drawing, it differs from the operation gestalt of the above 1st in that it has centrum 22a which carried out ***** of the base 22 of an elastic member 2 meat omission, and formed it. To the height of ***** of an elastic member 2, it cuts, ***** of base 22 base of an elastic member 2 is lacked, as shown in drawing 13, and, specifically, centrum 22a is formed so that clearly from drawing 14 which shows the rear face of elastic electric contact 1'. Thus, according to elastic electric contact 1' of this operation gestalt, since it has centrum 22a in the base 22 of an elastic member 2, according to the magnitude of centrum 22a, flexibility will increase to an elastic member 2.

[0025] An example of the process about elastic electric contact 1' of this operation gestalt is explained to the last. Although elastic electric contact 1' of this operation gestalt is also manufactured through the elastic member formation process and the conductive film formation process which were shown in drawing 3 thru/or

drawing 5 , and a thickening process, the device has developed in the elastic member formation process. That is, as shown in (a) of drawing 15 , while being filled up with silicon 2' in hole 100a of a mold 100, the insulating film 102 with centrum 22a and photoresist 102c of isomorphism is stuck. Under the present circumstances, the insulating film 102 is stuck on a mold 100 so that photoresist 102c may enter in hole 100a of a mold 100. after an appropriate time — conductivity — the film — a formation process — thickening — a process — pass — drawing 15 — (— b —) — being shown — as — an elastic member — two — conductivity — the film — three — a photoresist — 102 — c — having had — elasticity — electric contact — one — ' — manufacturing — although — this — a condition — **** — a photoresist — 102 — c — remaining — *** — since — this — a photoresist — 102 — c — removing — things — drawing 1515 — (— c —) — being shown — as — a centrum — 22 — a — having had — elasticity — electric contact — one — ' — it can manufacture . Since other configurations and the operation effectiveness are the same as the operation gestalt of the above 1st, the publication is omitted.

[0026] In addition, this invention is not limited to the above-mentioned operation gestalt, and various deformation and modification are possible for it within the limits of the summary of invention. For example, with the above-mentioned operation gestalt, although silicon was used as an elastic member 2, an elastic member 2 may be formed using urethane, rubber, etc. which have elasticity. Moreover, in the above-mentioned operation gestalt, although raw materials, such as lower layer 30a of the conductive film 3, were formed by titanium and palladium, it can also form with nickel or aluminum. Moreover, although ***** of up layer 30b was considered as gold plate with the above-mentioned operation gestalt, as long as it is not only this but a high conductivity metal, what kind of raw material is sufficient. Moreover, although the head 30 of the conductive film 3 was circularly set up with the above-mentioned operation gestalt, it is not the semantics limited to this. The polygon of a hexagon etc. is included in the configuration of a head 30. Moreover, with the above-mentioned operation gestalt, although thickness T of a head 30 was set up the twice of thickness t of a drum section 31 (extension section 32), not the semantics limited to this but thickness T of a head 30 can be set as the value between one to 10 times of thickness t of drum section 31 grade. Moreover, although titanium and palladium were vapor-deposited and the conductive film 3 was formed on the elastic member 2 through the hole 104 of a shadow mask 103 in the conductive film formation process with the operation gestalt of the above 1st, sputtering of titanium and the palladium can be carried out, and the conductive film 3 can also be formed on an elastic member 2. Moreover, although it cut and lacked to the height of ***** of an elastic member 2 and centrum 22a was formed with the operation gestalt of the above 2nd, the magnitude and the configuration of this centrum 22a are arbitrary. According to the degree of the flexibility desired to an elastic member 2, setting out of various magnitude or a configuration is possible.

[0027]

[Effect of the Invention] Since according to this invention the conductive film of elastic electric contact follows deformation of an elastic member and deforms as explained in detail above, the crack of the conductive film does not arise and there is outstanding effectiveness that the soundness of electrical installation improves.

[0028] Moreover, reinforcement of elastic electric contact can be attained by setting up the conductive thickness of the edge of elastic electric contact by 10 times [1 time to] the thickness of other parts.

[0029] Furthermore, the flexibility of whole elastic electric contact can be raised by performing meat omission of the base of an elastic member.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing elastic electric contact concerning the 1st operation gestalt of this invention.

[Drawing 2] It is the view A-A sectional view of drawing 1.

[Drawing 3] It is order process drawing showing an elastic member formation process.

[Drawing 4] It is order process drawing showing more conductive *****.

[Drawing 5] It is order process drawing showing a thickening process.

[Drawing 6] It is the sectional view showing elastic electric contact which appeared on the insulating film.

[Drawing 7] It is the sectional view showing the example which used elastic electric contact for INTAPOZA.

[Drawing 8] It is the sectional view showing the example of an activity of INTAPOZA.

[Drawing 9] It is the sectional view showing the condition that IC chip and the burn-in socket connected electrically through INTAPOZA.

[Drawing 10] It is a mimetic diagram for explaining the crack phenomenon of the conductive film.

[Drawing 11] It is the mimetic diagram showing an operation of the conductive film of this operation gestalt.

[Drawing 12] It is the perspective view showing elastic electric contact concerning the 2nd operation gestalt of this invention.

[Drawing 13] It is the view B-B sectional view of drawing 12.

[Drawing 14] It is the top view showing the rear face of electric contact.

[Drawing 15] It is process drawing showing the manufacture approach of elastic electric contact concerning the 2nd operation gestalt.

[Drawing 16] It is the fragmentary sectional view showing a Prior art.

[Description of Notations]

1 — Elastic electric contact 2 — Elastic member 3 — Conductive film 20 — Apical surface 21 — Side face 22 — Base 22a — Centrum 30 — Head 30a — Lower layer 30b — Up layer 31 — Drum section 32 — Extension section.

[Translation done.]

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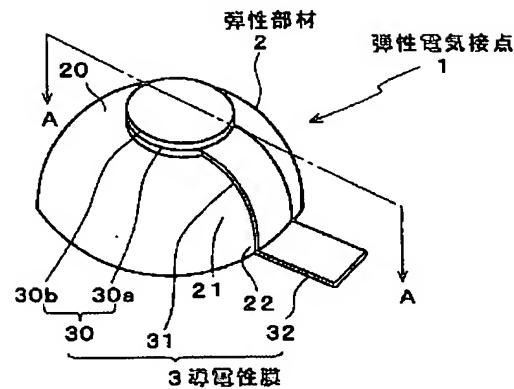
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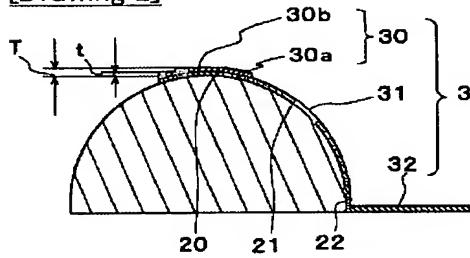
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DRAWINGS

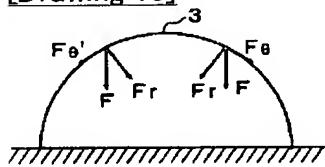
[Drawing 1]



[Drawing 2]

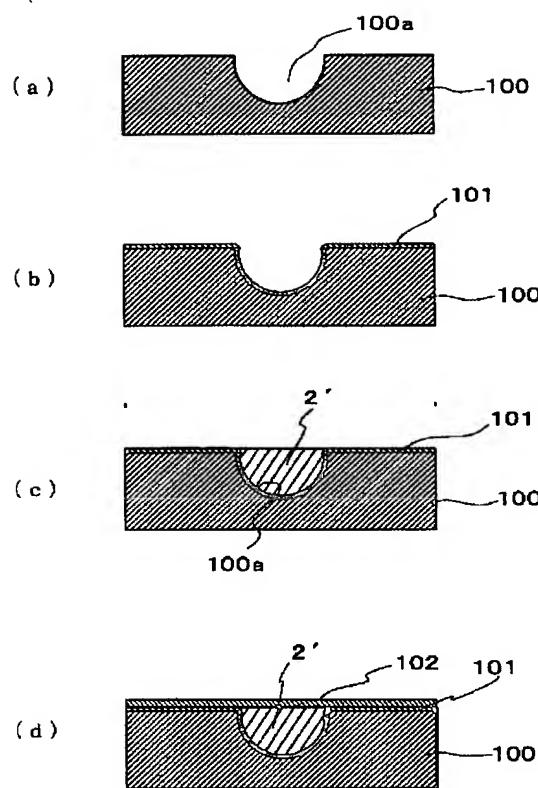


[Drawing 10]

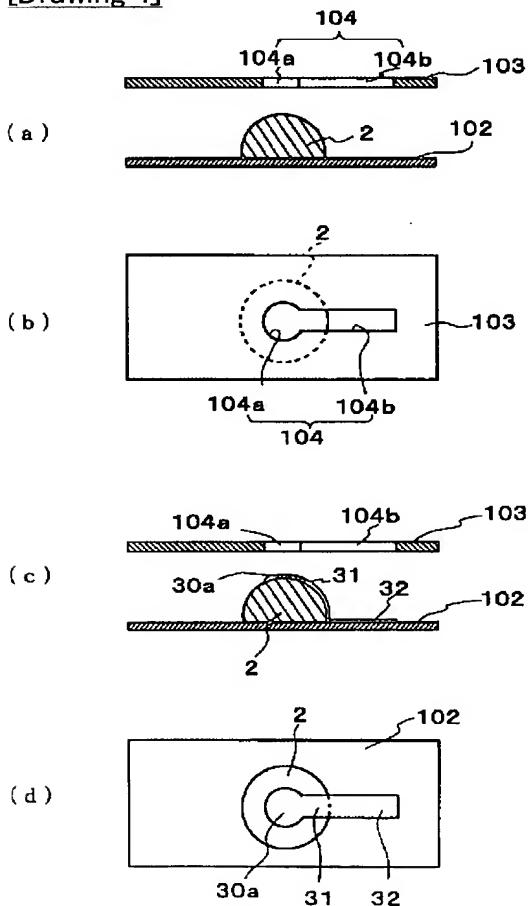


[Drawing 11]

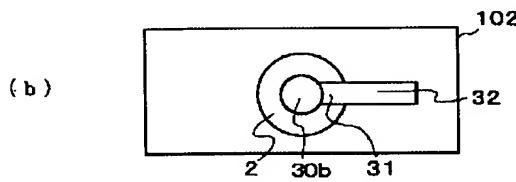
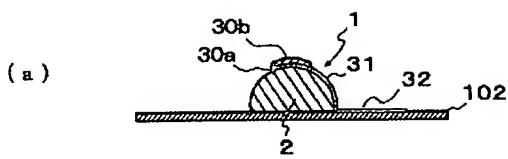
[Drawing 3]



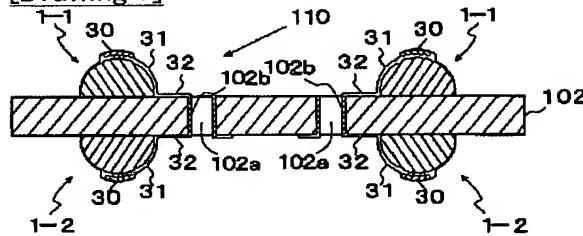
[Drawing 4]



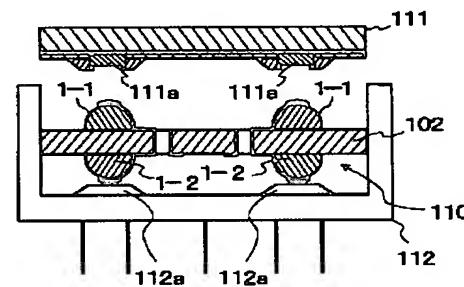
[Drawing 6]



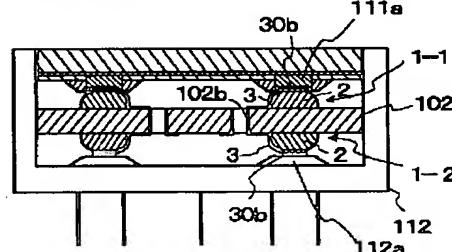
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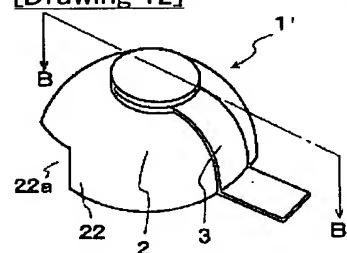
[Drawing 8]



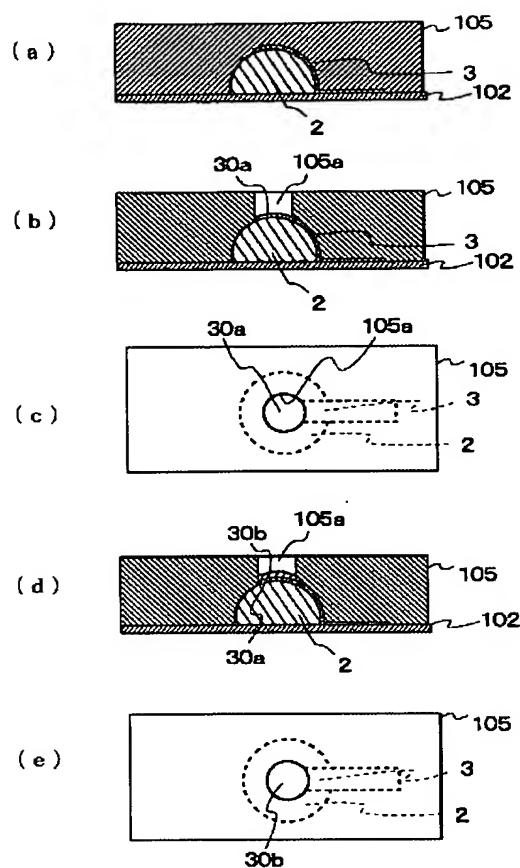
[Drawing 9]



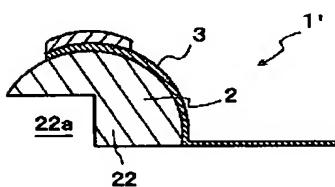
[Drawing 12]



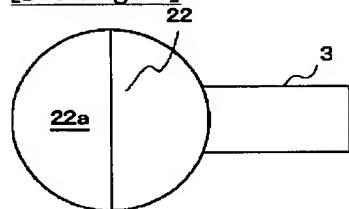
[Drawing 5]



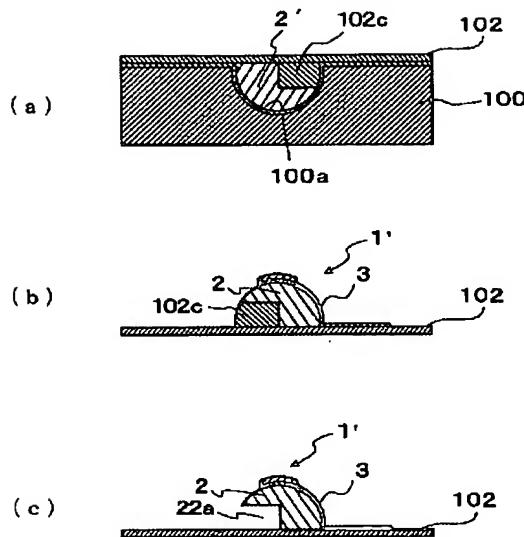
[Drawing 13]



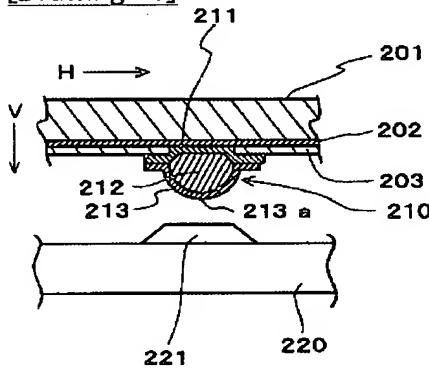
[Drawing 14]



<EMI ID=000016 HE=030 WI=043 LX=1440 LY=0450> [Drawing 15]



[Drawing 16]



[Translation done.]

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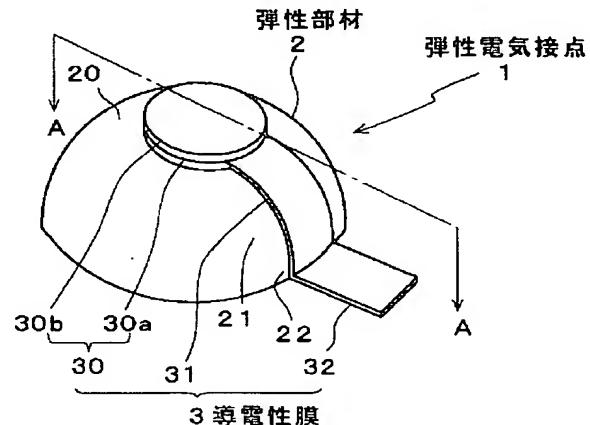
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(54)【発明の名称】 弾性電気接点

(57)【要約】

【課題】 寿命の長期化と確実な電気的接続が可能な弾性電気接点を提供する。

【解決手段】 弾性電気接点1を弾性部材2と導電性膜3で構成した。具体的には、シリコンを半球形状にして弾性部材2を形成し、弾性部材2の先端面20から側面21に沿って帯状の導電性膜3を付着した。導電性膜3は、チタン及びバラジウムによって一体に形成された頭部30と胴部31と延出部32とよりなる。そして、頭部30を下部層30aと金メッキの上部層30bとで形成した。



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【特許請求の範囲】

【請求項1】 略半球形状の弾性部材と、この弾性部材の先端面に端部を有し、且つこの先端面から弾性部材の表面に沿って弾性部材の基部側に至り、基部より外方に延出した帯状の導電性膜とを具備する、ことを特徴とする弾性電気接点。

【請求項2】 請求項1に記載の弾性電気接点において、上記導電性膜の端部の膜厚を他の部分の膜厚の1倍～10倍に設定した、ことを特徴とする弾性電気接点。

【請求項3】 請求項1または請求項2に記載の弾性電気接点において、上記弾性部材の基部の内抜きを行って当該基部に中空部を形成した、ことを特徴とする弾性電気接点。

【請求項4】 請求項1ないし請求項3のいずれかに記載の弾性電気接点において、上記弾性部材を、シリコンゴムで形成した、ことを特徴とする弾性電気接点。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、半導体基板、回路基板、インターボーバー、ICソケット、及びペアチップ検査用ソケット等に用いることができる弾性電気接点の構造に関するものである。

【0002】

【従来の技術】従来、この種の弾性電気接点として、特開昭61-259548号記載の技術がある。図16は、この従来の技術を示す部分断面図である。図16において、符号201、202、203は、それぞれ半導体基板、アルミ配線、絶縁層であり、半導体基板201のアルミ配線202に弾性電気接点210が電気的に接続されている。弾性電気接点210は、アルミやニッケルを真空蒸着法によってアルミ配線202に蒸着して形成したバリヤー層211と、バリヤー層211上にシリコンゴムをスクリーン印刷により略半球式に盛って形成した弾性部材212と、弾性部材212の全表面に一樣の厚さの金メッキを施して形成した導電性膜としての導電層213とで構成されている。

【0003】かかる構成により、半導体基板201とガラス基板220とを接近させ、弾性電気接点210とランド221とを接触させた状態で、半導体基板201又はガラス基板220の一方を他方側に押圧することにより、弾性部材212の弾性によって、弾性電気接点210とランド221との確実な電気接続を図るようにしている。

【0004】

【発明が解決しようとする課題】しかしながら、上記した従来の弾性電気接点210では、次のような問題があ

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る。まず、導電層213が弾性部材212の全表面を覆っているので、導電層213に亀裂が発生して、接続不良を起こし易い。即ち、弾性電気接点210をランド221上に押圧したときに、導電層213が弾性部材212に追従して変形することで、弾性電気接点210とランド221との確実な電気的接続が図られる。しかし、導電層213の弾性率が弾性部材212の弾性率比べて著しく小さく、しかも、導電層213が弾性部材212の全表面を覆った構造になっているので、弾性電気接点210の押圧時に、導電層213が弾性部材212に追従して変形せず、亀裂などを発生する可能性がある。次に、導電層213が摩耗して弾性電気接点210が短期間で使い物にならなくなる。即ち、半導体基板201を垂直方向Vに下げて、弾性電気接点210をランド221に接触させるが、実際には、弾性電気接点210とランド221との接触後に、半導体基板201が僅かに水平方向Hに移動する。このため、弾性電気接点210の先端部分である接触部分213aがランド221との摩擦によって摩耗することになる。このとき、導電層213が一樣の厚さの薄い金メッキであるので、摩擦の繰り返しによって短期間で導電層213の接触部分213aが摩耗してしまう。この結果、接触部分213aで弾性部材212がむき出しになり、弾性電気接点210が短期間で使用不可能になってしまふおそれがある。

【0005】この発明は上述した課題を解決するためになされたもので、寿命の長期化と確実な電気的接続が可能な弾性電気接点を提供することを目的とするものである。

【0006】

【課題を解決するための手段】上記課題を解決するためには、請求項1の発明に係る弾性電気接点は、略半球形状の弾性部材と、この弾性部材の先端面に端部を有し、且つこの先端面から弾性部材の表面に沿って弾性部材の基部側に至り、基部より外方に延出した帯状の導電性膜と具備する構成とした。かかる構成により、半導体基板等の電極に弾性電気接点の導電性膜を接続させた状態で、弾性部材の基部側を半導体基板に取り付け、弾性電気接点の先端部を回路基板のランドなどに接触させると、導電性膜の端部がランドに接触して、回路基板と半導体基板との電気的接続が図られる。半導体基板を回路基板側に押圧すると、弾性電気接点の弾性部材が変形するが、導電性膜が帯状に形成され、弾性部材全面を覆っていないので、導電性膜が弾性部材に追従して変形する。

【0007】さらに、請求項2の発明は、請求項1に記載の弾性電気接点において、導電性膜の端部の膜厚を他の部分の膜厚の1倍～10倍に設定した構成としてある。かかる構成により、回路基板のランド等との摩擦により弾性電気接点の導電性膜の端部が完全に摩耗して弾性部材が露出するまでに、端部の膜厚に対応した長期間の使用が可能である。

【0008】特に、請求項3の発明は、請求項1または請求項2に記載の弹性電気接点において、弹性部材の基部の内抜きを行って当該基部に中空部を形成した構成としてある。かかる構成のより、弹性部材の基部側に柔軟性が生じる。

【0009】ところで、弹性部材と導電性膜の材質は任意であるが、その好例として、請求項4の発明は、請求項1ないし請求項3のいずれかに記載の弹性電気接点において、弹性部材を、シリコンゴムで形成した構成としてある。

【0010】

【発明の実施の形態】以下、この発明の実施の形態について図面を参照して説明する。

(第1の実施形態) 図1は、この発明の第1の実施形態にかかる弹性電気接点を示す斜視図であり、図2は図1の矢視A-A断面図である。図に示すように、弹性電気接点1は、弹性部材2と導電性膜3を備えてなる。

【0011】弹性部材2は、シリコンを半球形状に型とて形成したもので、その先端面20から側面21に沿って帯状の導電性膜3が付着されている。

【0012】導電性膜3は、頭部30(端部)と胴部31と延出部32とよりなり、頭部30の下部層30aと胴部31と延出部32とが、チタン及びバラジウムによって一体に形成されている。

【0013】頭部30の下部層30aは、円形状をなし、弹性部材2の先端面20の上に付着されている。そして、この下部層30aの上に同形の上部層30bが積層されている。この上部層30bは金メッキにより形成されており、下部層30aと共に頭部30を構成している。

【0014】導電性膜3の胴部31は、帯状をなし、下部層30aから引き出された状態で、弹性部材2の側面21に沿って基部22に至っている。延出部32は、上記胴部31から引き出された状態で、弹性部材2の外方に所定長さだけ延出されている。そして、頭部30の厚さが他の胴部31や延出部32の厚さよりも上部層30bの厚さだけ厚くなっている。この実施形態では、頭部30の厚さTを胴部31(延出部32)の厚さtの2倍に設定した。

【0015】次に、この実施形態の弹性電気接点1の製造方法について説明する。弹性電気接点1は、次の弹性部材形成工程と導電性膜形成工程と増厚工程とを経て製造される。図3、図4、図5は、弹性部材形成工程、導電性膜形成工程、増厚工程をそれぞれ示す順工程図である。

【0016】まず、弹性部材形成工程においては、図3の(a)に示すように、半球形状の穴100aを有する型100を用意し、同図の(b)に示すように、離型剤101を型100の表面に塗布する。そして、離型剤101が乾燥した後に、同図の(c)に示すように、シリ

コン2'を型100の穴100a内に充填し、同図の(d)に示すように、絶縁フィルム102をシリコン2'を覆うように貼り付ける。しかる後、シリコン2'が固まって半球形状の弹性部材2を形成した後に、弹性部材2が固着した絶縁フィルム102を型100から剥離することで、弹性部材形成工程を終了する。

【0017】次に、導電性膜形成工程においては、図4の(a)に示すように、絶縁フィルム102に固着した弹性部材2の上にシャドウマスク103を配置する。図4の(b)は、同図(a)の上方から見た平面図である。この図に示すように、シャドウマスク103は円形孔104aと帯状孔104bとを有したマッチ棒状の孔104が穿設されている。従って、孔104を介して、チタン及びバラジウムを蒸着することで、図4の(c)に示すように、導電性膜3が弹性部材2上に成膜される。具体的には、図4の(d)に示すように、導電性膜3の下部層30aが弹性部材2の先端面に成膜され、胴部31が弹性部材2の側面に成膜される。そして、延出部32が絶縁フィルム102上に成膜されて、導電性膜形成工程が終了する。

【0018】最後に、増厚工程においては、図5の(a)に示すように、弹性部材2及び導電性膜3を覆うようにして、フォトレジスト105を絶縁フィルム102上に塗布する。そして、同図の(b)に示すように、導電性膜3の下部層30aと対応する部分をエッチングして、孔105aを形成する。図5の(c)は、同図の(b)の上方から見た平面図である。この図に示すように、孔105aは、下部層30aと同形状に設定されている。しかる後、同図の(d)及びこの図の上方から見た平面図(e)に示すように、フォトレジスト105の孔105aを介し手金メッキを行い、上部層30bを下部層30a上に付着させることで、増厚工程は終了する。

【0019】上記のように、弹性部材形成工程、導電性膜形成工程、増厚工程を順次実行した後、最後に、フォトレジスト105を除去することで、図6の(a)及び(b)に示すように、絶縁フィルム102上に載った弹性電気接点1を得ることができる。

【0020】次に、上記コネクタ1の使用例について説明する。図7は、弹性電気接点1をインターボーザに使用した例を示す断面図である。このインターボーザ110は、一对の弹性電気接点1(1-1, 1-2)を絶縁フィルム102の両面に取り付け、これらの弹性電気接点1-1, 1-2を絶縁フィルム102のスルーホール102aを介して電気的に連通した構造になっている。すなわち、内側面に銅箔102bが付着されたスルーホール102aが絶縁フィルム102の所定箇所に複数設けられている。そして、各スルーホール102aに近傍両面に、一对の弹性電気接点1-1, 1-2が配設され、各弹性電気接点1の延出部32が銅箔102bと電

気的に接続されている。

【0021】図8は、半導体基板としてのICチップとバーンインソケットとを接続するために、インターポーラー110を用いた例を示す断面図である。図8において、符号111がICチップであり、符号112がバーンインソケットである。図に示すように、インターポーラー110をバーンインソケット112内に収納すると、インターポーラー110の下側の弾性電気接点1-2がバーンインソケット112のランド112aと接触する。そして、ICチップ111をインターポーラー110の上に載置すると、インターポーラー110の上側の弾性電気接点1-1がICチップ111の電極111aに接触する。この状態で、ICチップ111とバーンインソケット112とを図示しない抑えバネなどで挟持すると、ICチップ111が下降してインターポーラー110を押圧する。これにより、図9に示すように、弾性電気接点1-1、1-2がインターポーラー110側に圧縮されるので、各弾性電気接点1-1（1-2）の弾性部材2の弾性力によって、弾性電気接点1-1の導電性膜3の上部層30bがICチップ111の電極111aに圧接し、弾性電気接点1-2の上部層30bがバーンインソケット112のランド112aに圧接する。この結果、電極111aとランド112aとが弾性電気接点1-1、1-2の導電性膜3及び絶縁フィルム102の銅箔102bを介して連通し、ICチップ111とバーンインソケット112とがインターポーラー110を介して電気的に接続された状態になる。

【0022】ところで、ICチップ111が下降すると、弾性電気接点1-1の導電性膜3の頭部30が電極111aによって下方に押圧されると共に、弾性電気接点1-2の導電性膜3の頭部30がランド112aによって上方に押圧される。このとき、弾性電気接点1の導電性膜3が弾性部材2の全面を被覆していないので、弾性部材2の変形に追従して撓むことになる。すなわち、例えば、導電性膜3が弾性部材2の全面を覆っているとすると、導電性膜3の断面は、図10に示すように、アーチ状の両端支持梁のごとき形状になる。このため、大きな下方力Fが働くと、接線方向の分力FθとFθ'による引っ張り力によって、導電性膜3が避けて亀裂が生じるおそれがある。これに対して、この実施形態の導電性膜3では、その断面が、図11に示すように、半アーチ状の片持ち梁のような形状をしているので、大きな下方力Fが働くと、その接線方向の分力Fθによる引っ張り力は働くが、導電性膜3が下方に撓むだけである。このように、この実施形態の弾性電気接点1によれば、弾性電気接点1への押圧時に導電性膜3に亀裂が生じることがないので、弾性電気接点1による確実な電気的接続が可能である。

【0023】また、ICチップ111のバーンインソケット112への脱着を繰り返すと、導電性膜3の頭部3

0が電極111aやランド112aの摩擦によって摩耗するが、上記のように、頭部30の厚さTが胴部31（延出部32）の厚さtの2倍に設定されているので、頭部30の大部分が摩耗して弾性部材2の先端部が露出するまでには、相当回数の着脱の繰り返しが必要である。従って、この弾性電気接点1の寿命は、上記した従来の弾性電気接点210の寿命に比べてきわめて長いといえる。

【0024】（第2の実施形態）図12は、この発明の第2の実施形態にかかる弾性電気接点を示す斜視図であり、図13は図12の矢視B-B断面図である。この実施形態の弾性電気接点1'は、図に示すように、弾性部材2の基部22の略半部を肉抜きして形成した中空部22aを有している点が、上記第1の実施形態と異なる。具体的には、弾性電気接点1'の裏面を示す図14から明らかなように、弾性部材2の基部22底面の略半部を、図13に示すように、弾性部材2の略半部の高さまで切り欠いて、中空部22aを形成している。このように、この実施形態の弾性電気接点1'によれば、弾性部材2の基部22に中空部22aを有しているので、中空部22aの大きさに応じて、弾性部材2に柔軟性が増加することになる。

【0025】最後に、この実施形態の弾性電気接点1'に関する製法の一例を説明しておく。この実施形態の弾性電気接点1'も、図3ないし図5に示した弾性部材形成工程と導電性膜形成工程と増厚工程とを経て製造されるが、弾性部材形成工程において工夫が高じられている。即ち、図15の（a）に示すように、シリコン2'を型100の穴100a内に充填すると共に、中空部22aと同形のフォトレジスト102cを有した絶縁フィルム102を貼り付ける。この際、フォトレジスト102cが型100の穴100a内に入り込むように、絶縁フィルム102を型100に貼り付ける。しかし後、導電性膜形成工程と増厚工程とを経て、図15の（b）に示すように、弾性部材2と導電性膜3とフォトレジスト102cとを有した弾性電気接点1'を製造するが、この状態では、フォトレジスト102cが残っているので、このフォトレジスト102cを除去することで、図15（c）に示すように、中空部22aを有した弾性電気接点1'を製造することができる。その他の構成、作用効果は上記第1の実施形態と同様であるので、その記載は省略する。

【0026】なお、この発明は、上記実施形態に限定されるものではなく、発明の要旨の範囲内において種々の変形や変更が可能である。例えば、上記実施形態では、弾性部材2としてシリコンを用いたが、弾性を有するウレタンやゴム等を用いて弾性部材2を形成しても良い。また、上記実施形態では、導電性膜3の下部層30a等の素材をチタン及びバラジウムで形成したが、ニッケルやアルミニウムで形成することもできる。また、上記実

施形態では、上部層30bの素材をを金メッキとしたが、これに限らず、高導電性金属であれば、いかなる素材でも良い。また、上記実施形態では、導電性膜3の頭部30を円形に設定したが、これに限定する意味ではない。頭部30の形状には、六角形などの多角形を含む。また、上記実施形態では、頭部30の厚さTを胴部31(延出部32)の厚さtの2倍に設定したが、これに限定する意味ではなく、頭部30の厚さTを胴部31等の厚さtの1~10倍の間の値に設定することができる。また、上記第1の実施形態では、導電性膜形成工程において、シャドウマスク103の孔104を介して、チタン及びバラジウムを蒸着して、導電性膜3を弹性部材2上に成膜したが、チタン及びバラジウムをスパッタリングして導電性膜3を弹性部材2上に成膜することもできる。また、上記第2の実施形態では、弹性部材2の略半部の高さまで切り欠いて、中空部22aを形成したが、この中空部22aの大きさや形状は任意である。弹性部材2に対して望まれる柔軟性の度合いに応じて、種々の大きさや形状の設定が可能である。

【0027】

【発明の効果】以上詳しく述べたように、この発明によれば、弹性電気接点の導電性膜が、弹性部材の変形に追従して変形するので、導電性膜の亀裂が生じることがなく、電気的接続の確実性が向上するという優れた効果がある。

【0028】また、弹性電気接点の端部の導電性膜厚を他の部分の膜厚の1倍~10倍に設定することにより、弹性電気接点の長寿命化を図ることができる。

【0029】さらに、弹性部材の基部の肉抜きを行うことで、弹性電気接点全体の柔軟性を向上させることができる。

* 【図面の簡単な説明】

【図1】この発明の第1の実施形態にかかる弹性電気接点を示す斜視図である。

【図2】図1の矢視A-A断面図である。

【図3】弹性部材形成工程を示す順工程図である。

【図4】導電性膜形成工程示す順工程図である。

【図5】増厚工程を示す順工程図である。

【図6】絶縁フィルム上に載った弹性電気接点を示す断面図である。

10 【図7】弹性電気接点をインターボーザに使用した例を示す断面図である。

【図8】インターボーザの使用例を示す断面図である。

【図9】ICチップとバーンインソケットとがインターボーザを介して電気的に接続した状態を示す断面図である。

【図10】導電性膜の亀裂現象を説明するための模式図である。

【図11】本実施形態の導電性膜の作用を示す模式図である。

20 【図12】この発明の第2の実施形態にかかる弹性電気接点を示す斜視図である。

【図13】図12の矢視B-B断面図である。

【図14】電気接点の裏面を示す平面図である。

【図15】第2の実施形態に係る弹性電気接点の製造方法を示す工程図である。

【図16】従来の技術を示す部分断面図である。

【符号の説明】

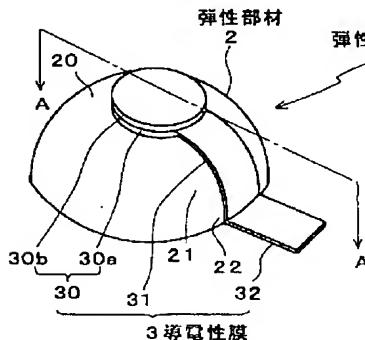
1…弹性電気接点、2…弹性部材、3…導電性膜、

20…先端面、21…側面、22…基部、22

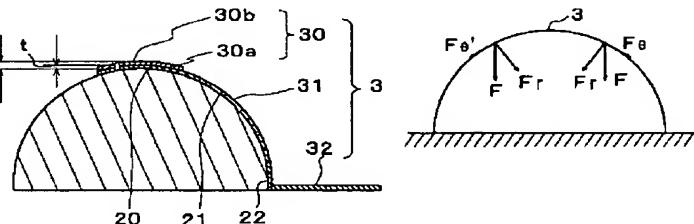
30…中空部、30…頭部、30a…下部層、30

b…上部層、31…胴部、32…延出部。

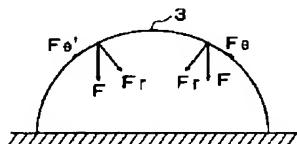
【図1】



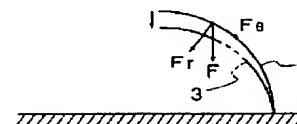
【図2】



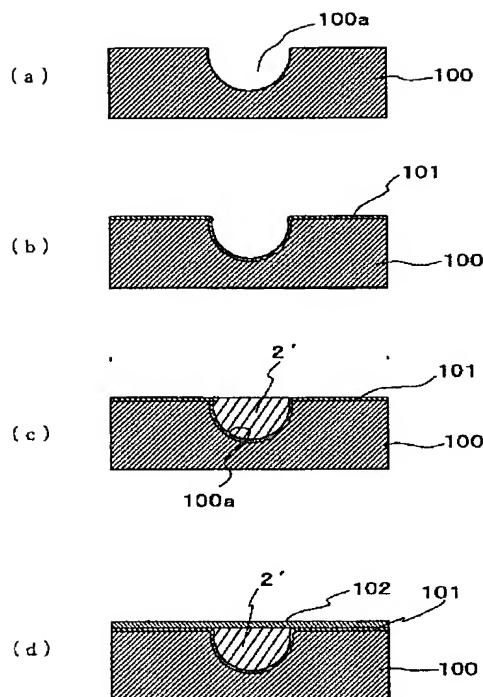
【図10】



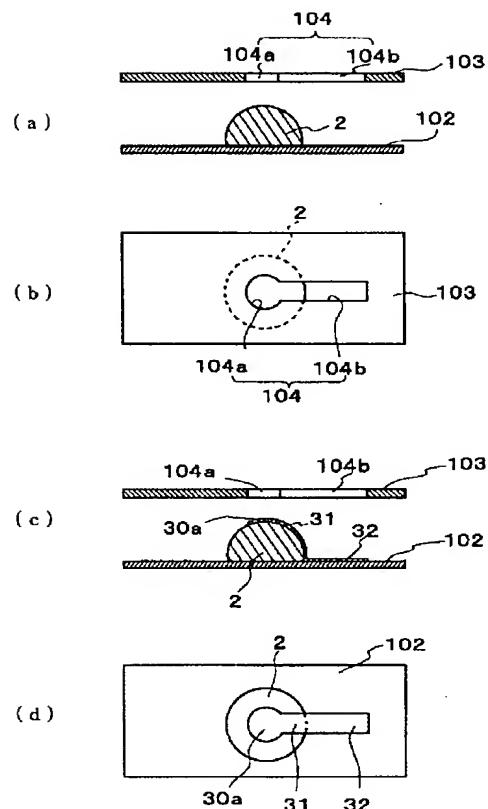
【図11】



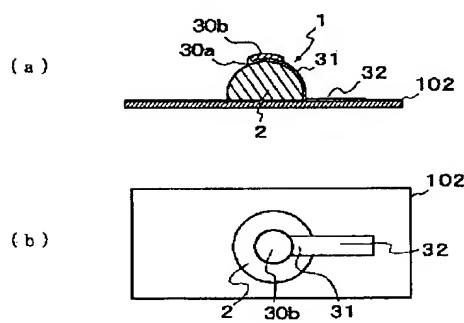
【図3】



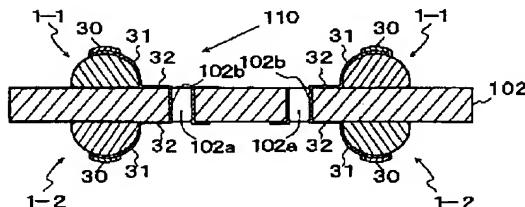
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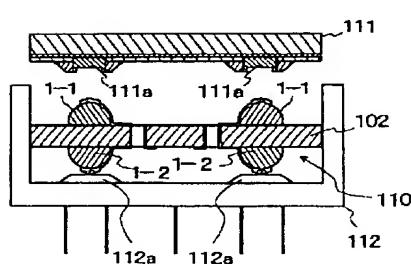
【図6】



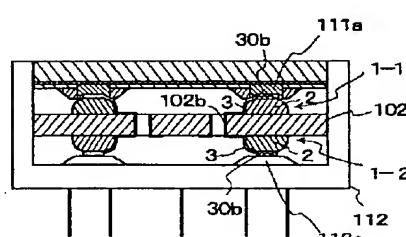
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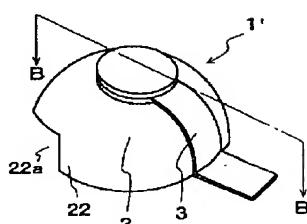
【図8】



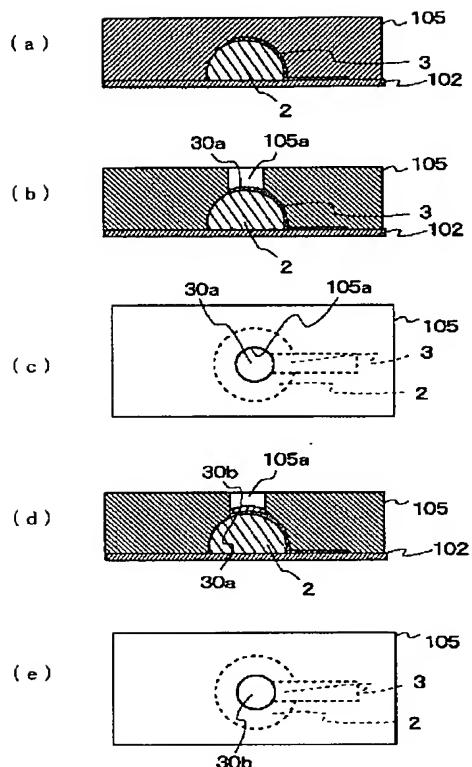
【図9】



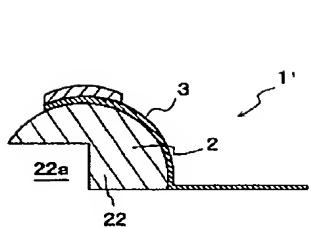
【図12】



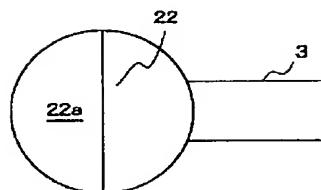
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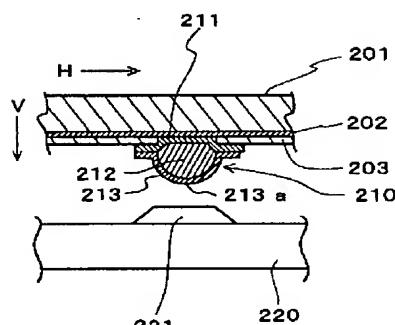
【図13】



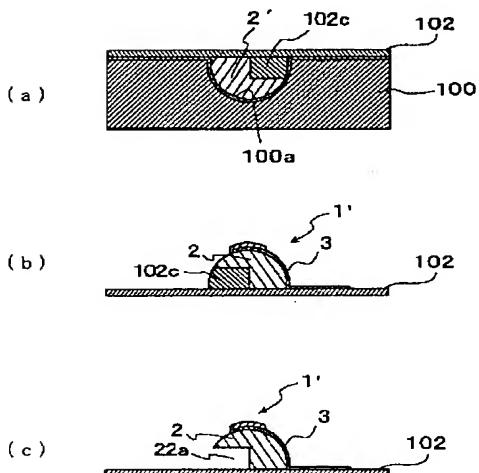
【図14】



【図16】



【図15】



フロントページの続き

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